

What is Claimed is:

- [c1] An apparatus for forming at least a portion of a semiconductor device, said apparatus comprising:
- a reaction chamber for heating a substrate on which the semiconductor device is to be formed;
 - a first source for supplying a first treating gas to said reaction chamber;
 - a first pumping system for maintaining said reaction chamber at a first vacuum pressure during the supplying of said first treating gas;
 - a second source for supplying a second treating gas to said reaction chamber;
 - a second pumping system for maintaining said reaction chamber at a second vacuum pressure during the supplying of said second treating gas, said second vacuum pressure being lower than said first vacuum pressure; and,
 - a third pumping system for transitioning said reaction chamber between said first vacuum pressure and said second vacuum pressure.
- [c2] An apparatus according to claim 1, wherein said reaction chamber, said first source and said first pumping system form at least part of a Low Pressure Chemical Vapor Deposition (LPCVD) system.
- [c3] An apparatus according to claim 2, wherein said reaction chamber, said second source and said second pumping system form at least part of an Ultra High Vacuum-Chemical Vapor Deposition (UHV-CVD) system.
- [c4] An apparatus according to claim 1, further comprising a load-lock chamber coupled to said reaction chamber for transferring said substrate between said reaction chamber and an external ambient, said load-lock chamber also being coupled to a turbomolecular pump and a mechanical pump in series.
- [c5] An apparatus according to claim 1, wherein said third pumping system is coupled to said reaction chamber and comprises a cryopump and a scroll pump arranged in series to remove contaminants from said reaction chamber after the supplying of said first treating gas.

- [c6] An apparatus according to claim 3, further comprising a first pumping system coupled to one end of said reaction chamber and forming therewith a portion of said LPCVD system, and a second pumping system coupled to another end of said reaction chamber and forming therewith a portion of said UHV-CVD system; wherein said first pumping system is also coupled to a roots blower and a mechanical pump in series; and wherein said second pumping system is also coupled to a turbomolecular pump, a roots blower and a mechanical pump in series.
- [c7] An apparatus according to claim 6, wherein said third pumping system is coupled to said reaction chamber and comprises a cryopump in series with a scroll pump for removing contaminants from said reaction chamber.
- [c8] An apparatus according to claim 1, wherein said reaction chamber, said first source and said first pumping system form at least a part of a Low Pressure Chemical Vapor Deposition (LPCVD) system for prebaking said substrate in a hydrogen containing gas and for forming silicon containing layers on said substrate; and wherein said reaction chamber, said second source and said second pumping system form at least part of an Ultra High Vacuum-Chemical Vapor Deposition (UHV-CVD) system for forming germanium (Ge), silicon (Si) or SiGe containing layers on said substrate.
- [c9] An apparatus according to claim 1, wherein said first pumping system comprises a roots blower and a mechanical pump in series.
- [c10] An apparatus according to claim 1, wherein said second pumping system comprises a turbomolecular pump, a roots blower and a mechanical pump in series.
- [c11] An apparatus according to claim 1, wherein said third pumping system comprises a cryopump and a scroll pump in series.
- [c12] An apparatus according to claim 1, wherein said first pumping system comprises a roots blower and a mechanical pump in series; wherein said second pumping system comprises a turbomolecular pump, a roots blower and a mechanical pump in series; and wherein said first pumping system and said

second pumping system share the same roots blower and mechanical pump.

[c13] A method for forming at least a portion of a semiconductor device, said method comprising steps of:

heating in a reaction chamber a substrate on which said semiconductor device is to be formed;
supplying a first treating gas to said reaction chamber from a first gas source;
maintaining said reaction chamber at a first vacuum pressure with a first pumping system during the supplying of said first treating gas to said reaction chamber;
stopping the supplying of said first treating gas and supplying a second treating gas to said reaction chamber from a second gas source;
maintaining said reaction chamber at the first vacuum pressure with the first pumping system during the supplying of said second treating gas to said reaction chamber,
supplying a third treatment gas and transitioning said reaction chamber between said first vacuum pressure and said second vacuum pressure using a third pumping system; and
supplying a fourth treatment gas at a second pressure and temperature.

[c14] A method according to claim 13, wherein said first treating gas and said first vacuum pressure in said reaction chamber provide a low pressure chemical vapor deposition of a layer of silicon on said substrate.

[c15] A method according to claim 14, wherein said first vacuum pressure is in the range of 100 to 500 mT.

[c16] A method according to claim 14, wherein said fourth treating gas and said second vacuum pressure in said reaction chamber provide an ultra high vacuum deposition of a layer of Ge, Si or SiGe on said substrate.

[c17] A method according to claim 16, wherein said second vacuum pressure is in the range of about 0.1 to 1.0 mT.

[c18] A method according to claim 13, wherein said fourth treating gas and said

second vacuum pressure in said reaction chamber provide an ultra high vacuum deposition of a layer of Ge, Si or SiGe on said substrate.

[c19] A method according to claim 13, wherein said third pumping system is coupled to said reaction chamber and comprises a cryopump and a scroll pump arranged in series to remove contaminates from said reaction chamber after the supplying of said first treating gas.

[c20] A method according to claim 13, wherein said first pumping system comprises a roots blower and a mechanical pump in series; wherein said second pumping system comprises a turbomolecular pump, a roots blower and a mechanical pump in series; and wherein said first pumping system and said second pumping system share the same roots blower and mechanical pump.

Downloaded from www.worldscientific.com by UNIVERSITY OF NEWCASTLE on 09/01/20